AF

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Michael S. Weaver et al.

Appln No.: 10/043,849

Filed: January 10, 2002

Title: OLEDS HAVING INCREASED EXTERNAL ELECTROLUMINESCENCE QUANTUM EFFICIENCIES

Art Unit: 2879

Examiner: Sharlene L. Leurig

Docket No.: UDC-20101

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Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF UNDER 37 C.F.R. §1.192

Sir:

As set forth in the Notice of Appeal filed by first-class mail on November 29, 2004, Appellants hereby appeal the final decision of the Examiner in the above-identified application rejecting claims 2-31, which are all of the pending claims in the application. Appellant respectfully requests that the Board of Patent Appeals and Interferences reverse the Examiner's rejection of the claimed subject matter.

This Appeal Brief is filed in triplicate as required.

I. BRIEF ON APPEAL

This appeal is from the examiner's final rejection of July 27, 2004.

II. REAL PARTY IN INTEREST

Universal Display Corporation is the assignee of the present invention and the real party in interest.

III. RELATED APPEALS AND INTERFERENCES

No other appeals or interferences within the meaning of 37 CFR 1.912(c) are known to Appellant, Appellant's legal representative, or the assignees, which will directly affect, be directly affected by, or have a bearing on the Board's decision in the pending appeal.

IV. STATUS OF CLAIMS

The presently pending claims are provided in the attached Appendix.

Claims 2-18, 21-27 and 31 stand finally rejected under 35 U.S.C. 103(a) as being unpatentable over Affinito US 6,268,695 in view of Duggal et al. US 2001/0033135 A1 (Duggal).

Claims 19 and 20 stand finally rejected under 35 U.S.C. 103(a) as being unpatentable over Affinito in view of Duggal and further in view of Fork US 6,339,289.

Claims 28-30 are listed as rejected in the Office Action Summary of the examiner's final rejection of July 27, 2004. However, no specific grounds of rejection are recited within the Detailed Action.

V. STATUS OF AMENDMENTS

A Final Office Action was mailed on July 27, 2004, rejecting Claims 2-31. A Response was filed subsequent to the Final Office Action on September 27, 2004, and in an Advisory Action mailed on October 18, 2004, the Examiner indicated that the request

for reconsideration was considered but did not place the application in condition for allowance. A Notice of Appeal was filed by first-class mail on November 29, 2004, and received by the Patent and Trademark Office on December 3, 2004. The claims have not been amended subsequent to the final rejection.

VI. SUMMARY OF INVENTION

The invention is adequately described in claim 10, the only independent claim as follows:

> 10. An OLED device comprising:
>
> (a) a substrate;
>
> (b) an active region positioned over said substrate, wherein said active region comprises an anode layer, a cathode layer and a light-emitting layer disposed between the anode layer and the cathode layer; and
>
> (c) a composite barrier layer disposed over said active region or under said active region, said composite barrier layer comprising an alternating series of one or more polymeric planarizing sublayers and one or more high-density sublayers, at least one of said polymeric planarizing sublayers having microparticles incorporated therein, said microparticles being effective to increase the out-coupling efficiency of the OLED.

Novel and unobvious improvements are reflected, for example, in paragraph (c). A planarizing layer or sublayer is one "that forms a smooth planar surface upon application rather than forming a surface that reflects irregular contours of the underlying surface." This specification, paragraph [0047]. The function of the microparticles is defined in the claim.

One advantage of the here claimed OLED is that it has an increased out-coupling efficiency, relative to various prior art devices, resulting in a more luminous display in constructions that incorporate it.

Another advantage is that the use of a polymer multi-layer (PML) composite barrier layer (a) provides a conformal coating over an OLED device (b) that protects the OLED device from oxygen and moisture, which result in deterioration of such devices.

In the present invention, the PML structure provides both OLED device protection and increased out-coupling efficiency.

VII. ISSUES

Would the subject matter of the appealed claims have been obvious to one of ordinary skill in the relevant art at the time the invention was made?

VIII. GROUPING OF CLAIMS

Within the two separate rejections, claims have not been argued separately.

IX. ARGUMENT

The following legal authorities are relied on in the following argument in the order in which they are cited:

In re Jones, 958 F.2d 347, 351, 21 USPQ2d 1941, 1943-44 (Fed. Cir. 1992)

In re Fine, 837 F.2d 1071, 1075, 5 USPQ2d 1596, 1598-99 (Fed. Cir. 1988)

MPEP §2143

MPEP §2143.01, second subheading (emphasis added) (citing *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990))

In re Baird, 16 F.3d 380, 29 USPQ2d 1550 (Fed. Cir. 1994)

Bausch Lomb, Inc. v. Barns-Hind Hydrocurve, 796 F.2d 443, 449, 230 USPQ 416, 420 (Fed. Cir. 1986)

W.L.Gore & Associates, Inc. v. Garlock, Inc., 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied,* 469 U.S. 851 (1984)

MPEP §2143.02

Akzo N.V. v. U.S. International Trade Commission, 808 F.2d1471, 1480-81, 1 USPQ2d 1241, 1246 (Fed. Cir. 1986), *cert. denied*, 482 U.S. 909 (1987)

Loctite Corp. v. Ultraseal Ltd., 781 F.2d 861, 874, 228 USPQ 90, 99 (Fed. Cir. 1985)

MPEP §2142, second paragraph

In re Lange, 280 F.2d 165, 126 USPQ 365, 367 (Fed. Cir. 1960).

A. Rejection of Claims 2-18 and 21-27 and 31 under 35 U.S.C. 103(a)

Claims 2-18 and 21-27 and 31 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Affinito U.S. 6,268,695 and Duggal et al U.S. published application 2001/00331135 A1 (Duggal).

In order to establish a *prima facie* case of obviousness under 35 U.S.C. §103(a), there must be some suggestion or motivation to modify/combine the references of record, and (b) there must be a reasonable expectation of success. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure. *Id.* In re Jones, 958 F.2d 347, 351, 21 USPQ2d 1941, 1943-44 (Fed. Cir. 1992); In re Fine, 837 F.2d 1071, 1075, 5 USPQ2d 1596, 1598-99 (Fed. Cir. 1988). See also MPEP §2143. The mere fact that references *can* be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination or modification. MPEP 2143.01, second subheading (emphasis added) (citing *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir.1990)).

For convenience claim 10 shall be repeated here, with various limitations emphasized.

> 10. An OLED device comprising:
>
> (a) a substrate;
>
> (b) an active region positioned over said substrate, wherein said active region comprises an anode layer, a cathode layer and a light-emitting layer disposed between the anode layer and the cathode layer; and
>
> (c) a composite barrier layer disposed over said active region or under said active region, said composite barrier layer comprising an alternating series of one or more polymeric planarizing sublayers and one or more high-density sublayers, at least one of said polymeric planarizing sublayers having microparticles incorporated therein, said microparticles being effective to increase the out-coupling efficiency of the OLED.

The References:

Affinito

Affinito, cited in the Office Action, is directed to a device in which an OLED 160 is constructed over a flexible environmental barrier, specifically, a composite foundation 110. See, e.g., col. 2, line 54 to col. 3, line 13, Fig. 1, and col. 4, lines 7-10. The composite foundation 110 includes a substrate 150, a first polymer layer 132, a ceramic layer 134, and a second polymer layer 136. *Id.* (The foundation can further include an intermediate polymer layer 142 and an intermediate ceramic layer 144. See Fig. 2.) Such polymeric and ceramic layers have been shown to render a polymer substrate (i.e., a PET substrate) more than three orders of magnitude less permeable to oxygen and water vapor than the case where a sole ceramic layer (i.e., oxide layer) is provided on the polymer substrate. *Id.* at col. 1, lines 28-33.

In contrast to polymers, ceramic layers are known to be quite impermeable to oxygen. Unfortunately, according to Affinito, in certain structures (e.g., oxide coated substrates), the oxide layer is believed to be prone to fracture, adversely affecting the barrier properties of the structure. See, e.g., col. 1, lines 43-67 of Affinito. The inclusion of polymer smoothing layers in these structures, however, is believed to cover various rough, sharp and/or uneven features, thereby protecting the oxide layer from fracture. *Id.*

Duggal

Duggal discloses OLEDs having a "coupler" layer that is either corrugated or contains microparticles (compare Figures 1,2 and 3). The two types of coupler are equivalent for the purposes of Duggal, which is to match indices of refraction between adjacent layers of the OLED. See, e.g., the Abstract.

The rejection is based on the examiners opinion that, it "would have been obvious to one of ordinary skill in the art at the time of the invention to modify the OLED disclosed by Affinito to have microparticles formed in a polymeric planarizing sublayer of the composite barrier layer in order to improve the out-coupling of the device by

increasing the amount of scattered light, as taught by Duggal." The examiner concludes erroneously.

First, even assuming solely for the sake of argument that it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the OLED disclosed by Affinito to have microparticles in order to improve the out-coupling of the device, there is no teaching or suggestion to place such microparticles within a polymeric planarizing sublayer of a composite barrier layer, as claimed in claim 10, for example, as opposed to placing the microparticles within a device layer that does not provide a planarizing function. It should be noted that nowhere in Duggal does the concept of a "planarizing" layer appear.

Indeed, it is respectfully submitted that one of ordinary skill in the art would actually have been dissuaded from providing microparticles within a polymeric planarizing sublayer of a composite barrier layer of Affinito. For example, as noted above, it is understood from Affinito that the function of the polymer smoothing layers is to cover various rough, sharp and/or uneven features that may be present, thereby protecting the adjacent oxide layers from fracture. Being aware of this, it is submitted that one of ordinary skill in the art would have been dissuaded from adding particulate matter to polymer smoothing layers such as those of Affinito. This is true, for example, because adding solid particles to a layer whose function is to cover and smooth underlying features is antithetical to achieving that function. In other words Duggal "teaches away" from combination with Affinito and/or the present invention. In re Baird, 16 F.3d 380, 29 USPQ2d 1550 (Fed. Cir. 1994), Bausch Lomb, Inc. v. Barns-Hind Hydrocurve, 796 F.2d 443, 449, 230 USPQ 416, 420 (Fed. Cir. 1986), W.L.Gore & Associates, Inc. v. Garlock, Inc., 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied,* 469 U.S. 851 (1984), MPEP 2143.02.

The examiner argues that Duggal "explicitly teaches that the polymer layer containing microparticles is not necessarily rough," but does not refer to the location within Duggal where this explicit statement is made. The examiner also notes that the layer of Duggal "may 'contain dimples or corrugations' shown in Figures 1 and 2 only 'if desired' (page 4, paragraph 0046)." However, this statement from Duggal refers to the

deliberate introduction of surface contours at the air interface of the layer, and says nothing about the surface roughness of polymer layers containing microparticles.

Upon mere perusal of the examiner's rejection it is clear that it relies on undue and thus forbidden hindsight. See, for example, Akzo N.V. v. U.S. International Trade Commission, 808 F.2d1471, 1480-81, 1 USPQ2d 1241, 1246 (Fed. Cir. 1986), *cert. denied*, 482 U.S. 909 (1987), Loctite Corp. v. Ultraseal Ltd., 781 F.2d 861, 874, 228 USPQ 90, 99 (Fed. Cir. 1985). See also, MPEP 2142, second paragraph.

For at least these reasons, it is respectfully submitted that claim 10 is patentable over Affinito and Duggal. Claims 2-9 and 11-31 depend from claim 10 and are therefore patentable for at least the same reasons as is claim 10.

B. Rejection of Claims 19 and 20 under 35 U.S.C. 103(a)

Claims 19 and 20 have been finally rejected under 35 U.S.C. 103(a) as being unpatentable over Affinito in view of Duggal and further in view U.S. Patent No. 6,339,289 (Fork).

The References:

Affinito and Duggal

Affinito and Duggal are described above.

Fork

Fork discloses an OLED designed to prevent dark spots and thus improve imaging. That purpose is accomplished by use of "an environmental barrier. . . which has a foundation and a top." There is no explicit disclosure of planarizing layers or microparticle layers.

As noted above, claim 10 is patentable over Affinito and Duggal, at least because these references neither teach nor suggest placing microparticles within a polymeric planarizing sublayer of a composite barrier layer, as opposed to, for example, placing the microparticles within a device layer that is not required to also provide a planarizing function.

Fork, which is cited for its alleged disclosure of an OLED with pixels that are 300 microns across to prevent dark spots and improve imaging, does not make up for these deficiencies in Affinito and Duggal. Its citation merely increases the amount of undue hindsight in the rejection. Therefore, claim 10 is patentable over Affinito, Duggal and Fork.

Claims 19 and 20 depend from claim 10 and are therefore patentable over Affinito, Duggal and Fork for at least the same reasons as is claim 10.

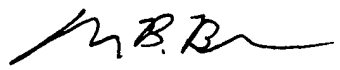
X. CONCLUSION

The references relied on by the examiner do not support a *prima facie* case of obviousness. Thus, it is respectfully submitted that reversal of the rejections of record is in order.

XI. FEES

The Office is authorized to charge any fees due and owing in respect to the filing of this paper to deposit account number 50-1047.

Respectfully submitted,



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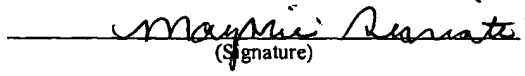

(Signature)

APPENDIX

1. (Cancelled)

2. (Previously presented) The OLED of claim 10, wherein the substrate comprises an inorganic material or an organic material.

3. (Original) The OLED of claim 2, wherein the substrate comprises a transparent material.

4. (Original) The OLED of claim 2, wherein the substrate comprises glass, metal, or a silicon-based material.

5. (Original) The OLED of claim 2, wherein the substrate comprises a polymeric material.

6. (Original) The OLED of claim 5, wherein the substrate comprises a flexible polymeric material.

7. (Original) The OLED of claim 5, wherein the substrate comprises one or more polymeric materials selected from the group consisting of polyesters, polyolefins, polycarbonates, polyethers, polyimides and polyfluorocarbons.

8. (Previously presented) The OLED of claim 10, wherein a polymeric sublayer having said microparticles incorporated therein is disposed on a top surface of said substrate.

9. (Original) The OLED of claim 8, wherein the substrate comprises glass or a transparent flexible polymeric material.

10. (Previously presented) An OLED device comprising:

(a) a substrate;

(b) an active region positioned over said substrate, wherein said active region comprises an anode layer, a cathode layer and a light-emitting layer disposed between the anode layer and the cathode layer; and

(c) a composite barrier layer disposed over said active region or under said active region, said composite barrier layer comprising an alternating series of one or more polymeric planarizing sublayers and one or more high-density sublayers, at least one of said polymeric planarizing sublayers having microparticles incorporated therein, said microparticles being effective to increase the out-coupling efficiency of the OLED.

11. (Original) The OLED of claim 10, wherein said composite barrier layer is disposed on a top surface of said substrate.

12. (Original) The OLED of claim 11, wherein said substrate comprises glass or a transparent flexible polymeric material.

13. (Original) The OLED of claim 10, wherein said composite barrier layer comprises an alternating series of two or more polymeric planarizing sublayers and two or more high-density sublayers.

14. (Original) The OLED of claim 13, wherein said composite barrier layer is disposed over said active region.

15. (Original) The OLED of claim 13, wherein said microparticles are incorporated within at least two of said polymeric planarizing sublayers.

16. (Original) The OLED of claim 13, wherein said composite barrier layer is disposed on said substrate, and said microparticles are incorporated within a polymeric planarizing sublayer closest to said substrate.

17. (Original) The OLED of claim 13, wherein said composite barrier layer is disposed on said substrate, and said microparticles are incorporated within a polymeric planarizing sublayer closest to said active region.

18. (Original) The OLED of claim 10, wherein said composite barrier layer is disposed over said active region.

19. (Previously presented) The OLED of claim 10, wherein the active region comprises a pixel and the size of said microparticles is smaller than the smallest lateral dimension of said pixel.

20. (Original) The OLED of claim 19, wherein the largest dimension of said pixel is from about 10 μm to about 300 μm and the size of said microparticles is from about 0.4 μm to about 10 μm.

21. (Previously presented) The OLED of claim 10, wherein said microparticles comprise a transparent inorganic or polymeric material.

22. (Original) The OLED of claim 21, wherein said microparticles comprise glass.

23. (Original) The OLED of claim 21, wherein said microparticles comprise a metal, a metal oxide or a ceramic material.

24. (Original) The OLED of claim 23, wherein said microparticles comprise TiO_2.

25. (Previously presented) The OLED of claim 10, wherein said microparticles comprise a material having a refractive index of about 1.7 or greater.

26. (Previously presented) The OLED of claim 10, wherein the refractive index of said microparticles is different from the refractive index of said polymeric sublayer.

27. (Previously presented) The OLED of claim 26, wherein the difference between the refractive index of said microparticles and the refractive index of said polymeric sublayer is greater than about 0.3.

28. (Original) The OLED of claim 10, wherein said polymeric planarizing sublayer comprises a material selected from the group consisting of fluorinated polymers, parylenes, cyclotenes and polyacrylates.

29. (Original) The OLED device of claim 10, wherein said high-density material is selected from the group consisting of metals, metal oxides, metal nitrides, metal carbides and metal oxynitrides.

30. (Original) The OLED device of claim 10, wherein said high-density material is selected from the group consisting of silicon, silicon oxides, silicon nitrides, silicon carbides, silicon oxynitrides, indium oxides, indium tin oxides, zinc indium tin oxides, tin oxides, aluminum oxides, aluminum nitrides, and titanium oxides.

31. (Previously presented) The OLED device of claim 10, wherein said OLED device comprises a first composite barrier layer disposed over said active region and a second composite barrier layer disposed under said active region.